

Niagara Falls Already Ruined

Concessions for Power Plants Already Granted Sufficient to Use All the Water—
The Remedy

By ALTON D. ADAMS

Consulting Hydraulic Engineer

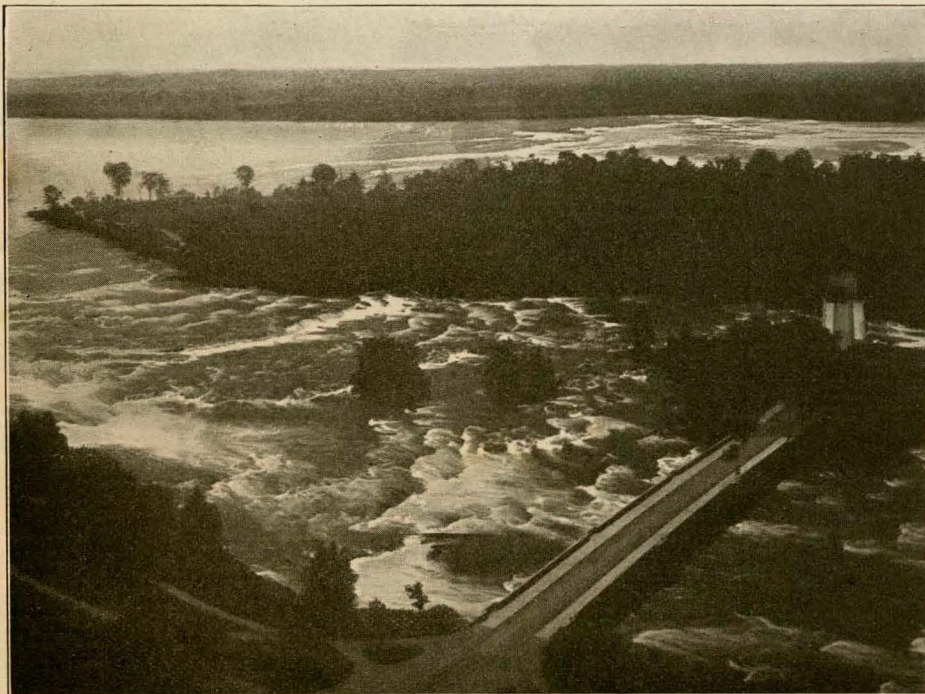
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NIAGARA FALLS are already ruined! Already enough water rights have been granted by New York State and Canada to divert all the water which now, falling over both the American and the Canadian falls, makes the great cataract one of the natural wonders of the world. If the capitalists and promoters who now hold franchises were all to establish plants, the entire flow of Niagara river would be diverted into underground channels; and the mighty cliff over which the torrent now pours in resistless grandeur would be left rugged and bald and dry.

That is the situation. What, now is the remedy?

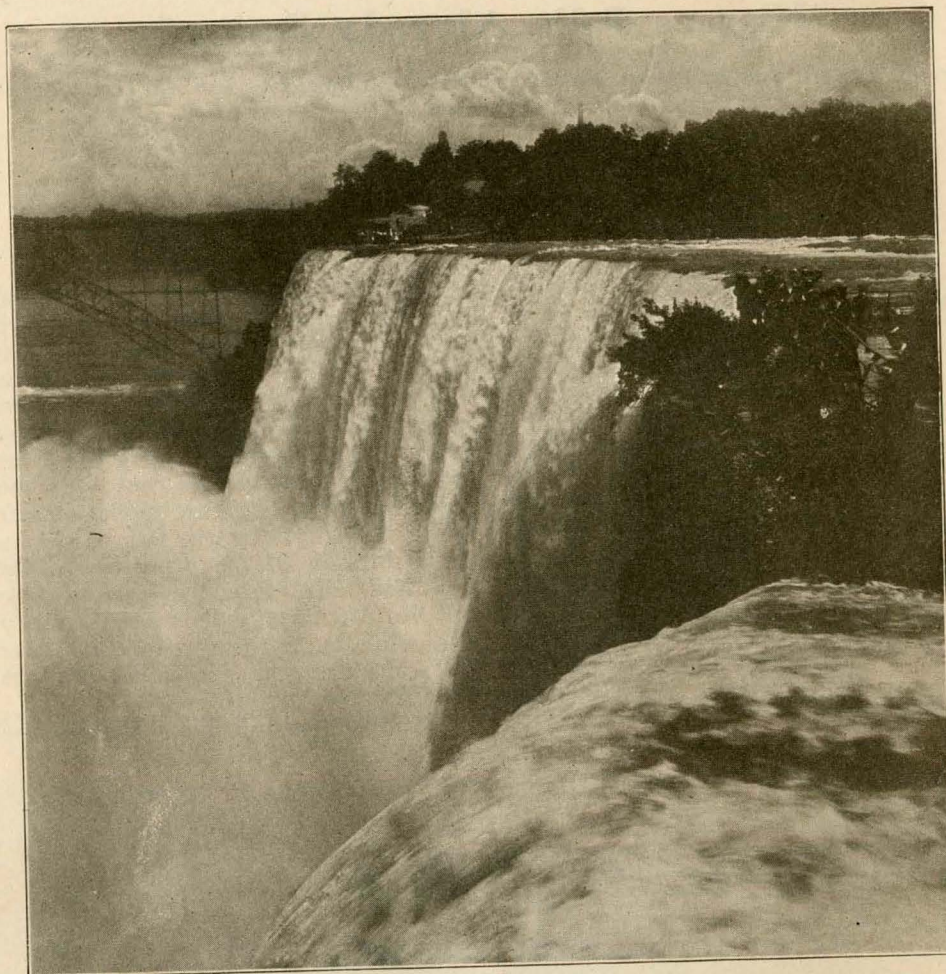
In the first place it is to be considered that the American Falls are in much more imminent danger than the Canadian. The pipe line, canal, and tunnels that already pierce the cliffs between the upper river and Niagara Gorge, are large enough in themselves to carry twice the amount of water which runs over the American Falls. And the depth of water above the brink of these falls is only a small fraction of the depth above the Canadian falls. It is therefore possible for the American Falls to run entirely dry, while an imposing depth of water still runs over the Horseshoe on the Canadian side.

One suggestion looking towards the



HEAD OF THE NIAGARA RAPIDS.

American Channel, Goat Island, Bath Island, and the Canadian Channel, as seen from the New York shore.



NIAGARA IN FULL FLOW.
View of the American Falls, taken from Goat Island.

preservation of Niagara, is that a treaty be negotiated between the United States and Great Britain, which shall take the whole matter out of the field of commercial speculation.

Quick Action Needed

Evidently, if anything is to be done by treaty to save the American Falls, it must be done quickly, or it will cost untold millions to buy out vested interests. But the logic of the situation is against any prompt, decisive action in the way of international agreement. Under the Constitution of the United States, New York has no power to enter into any treaty with Canada or Great Britain as to Niagara Falls. A treaty between the

United States and Great Britain looking to the preservation of the American Falls can of course be reached only by mutual agreement; and it is at least probable that Canada will oppose such a treaty to the full extent of her great influence with the mother country. This forecast of the probable attitude of Canada is based on two important facts: one of these is the greater width and depth of the Canadian channel, which insures a lusty flow of water over the Horseshoe Falls after the American channel is dry and bare. At the head of Goat Island, the American channel has no more than 15 per cent of the entire width of Niagara river; and it is most probable that no considerable part of that channel reaches a depth of



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DRY NIAGARA.

The American Falls at low water caused by ice-jam in channel above. Showing scenic effects of depletion of channel. Compare with view on opposite page taken from practically same spot.

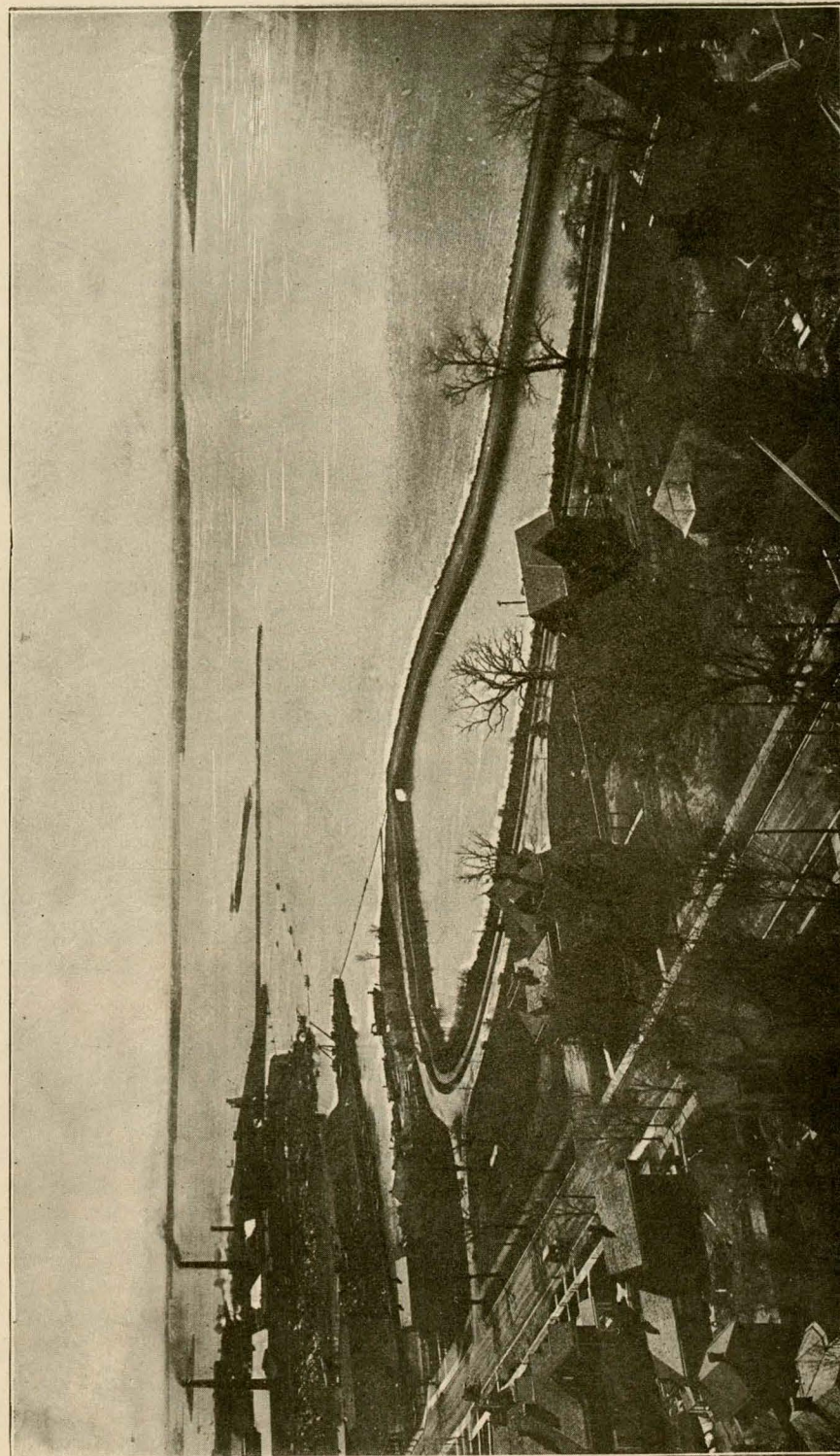
10 feet, while much of it is covered with only three or four feet of water. The Canadian channel not only occupies 85 per cent of the entire width of the stream, but also has a depth in parts of at least 26 feet, as was discovered in building the cofferdam for one of the power plants in Queen Victoria Park.

Question of Revenue

The other highly important fact bearing on the probable attitude of Canada toward any treaty that has for its object the preservation of the American Falls, is the great possible revenue that the Government of the Dominion may derive from the rental of water rights. Already

Ontario Province receives through the Commissioners of Queen Victoria Niagara Falls Park a minimum annual rental of \$60,000 for the water rights granted there; and when the power plants for which these grants were made are operated at their full capacity, the annual revenue to the Government therefrom will rise to more than \$300,000.

According to the report made to these Commissioners by an engineer employed for that purpose, power plants which would divert another 30,000 cubic feet of water per second from the upper Niagara river—raising the total volume covered by grants from the Ontario Government to 62,000 cubic feet per second



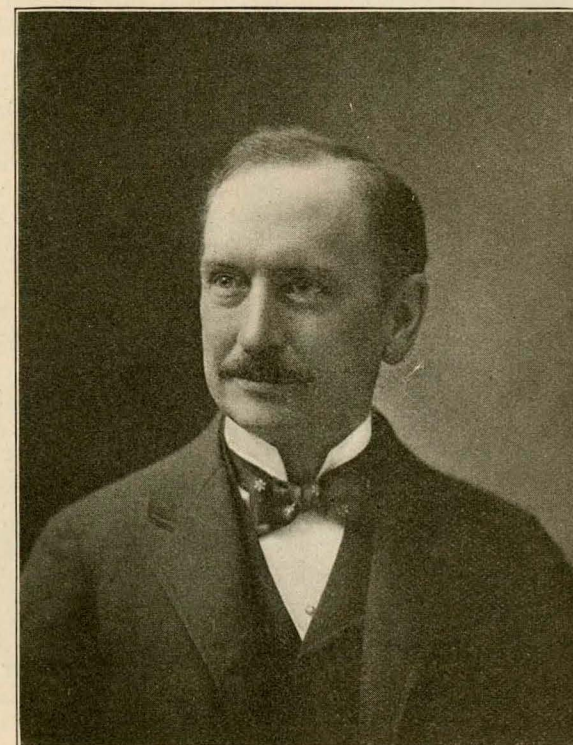
NIAGARA RIVER ABOVE GOAT ISLAND.
View from New York bank.

—could be conveniently located near Queen Victoria Park. Such a grant, at the water rates previously exacted, would raise the annual revenue of the Ontario Government to more than \$600,000 per year from this source; and even then only one-half of the discharge of 165,000 cubic feet per second that comes

willingly forego the princely revenue named above, in order to save the American Falls?

Deepen American Channel

Fortunately it is not necessary to await the uncertain termination of the negotiation of a foreign treaty, in order to pre-



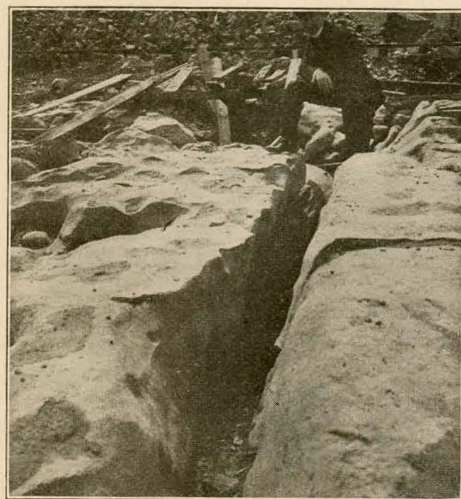
HON. THEODORE E. BURTON.

Representative in Congress from Cleveland, O., who has introduced a joint resolution intended to save Niagara Falls.

down Niagara river would be diverted, if the capacity of power plants on the New York side of the Falls was not increased. Long before the rentals due the Ontario Government reached this last-named figure, however, the American Falls would disappear. As Canada would still have the Horseshoe Falls but little impaired by the diversion of some 80,000 cubic feet of water per second, is it probable that the Government there, out of kindness to the United States, would

serve the cataract between Goat Island and the New York bank. New York State has it within its power so to deepen the river channel south of Goat Island, and between that island and the New York bank, that the American Falls will always divide with the Horseshoe whatever water is not diverted from its natural bed.

Under the Treaty of Ghent, the international boundary line in Niagara river passes some 1,200 feet from the head of



LARGE FISSURE IN HARD LIMESTONE OF CHANNEL
ABOVE THE FALLS.

Goat Island and toward the Canadian bank, where it crosses the upper line of breakers. Before it reaches the Horseshoe Falls, this boundary line passes within about 135 feet of that part of the crest where the recession goes on at the most rapid rate, and where the water is supposed to be the deepest. This location of the boundary carries the territory of New York well out into the deeper part of the river; and an ample supply of water for the American Falls can be assured by excavating a new channel from a point near this line, down past the head of Goat Island, to or below Bath Island. Such excavation will simply bring the channel to and along the American rapids down more nearly to a level with the channel between Goat Island and the Canadian bank. When this is done, whatever water remains in the natural bed of the river will divide between both the American and the Horseshoe Falls. As it is at present, the lowering by several feet of the river above Goat Island, through the pending diversion of water into the tunnels, pipe lines, and canals of existing and authorized power plants, will lay bare the channel between Goat Island and the New York bank, and will destroy the American Falls, because the limestone bed of this channel lies some seven to twenty feet higher in parts than that of the channel which leads down to the

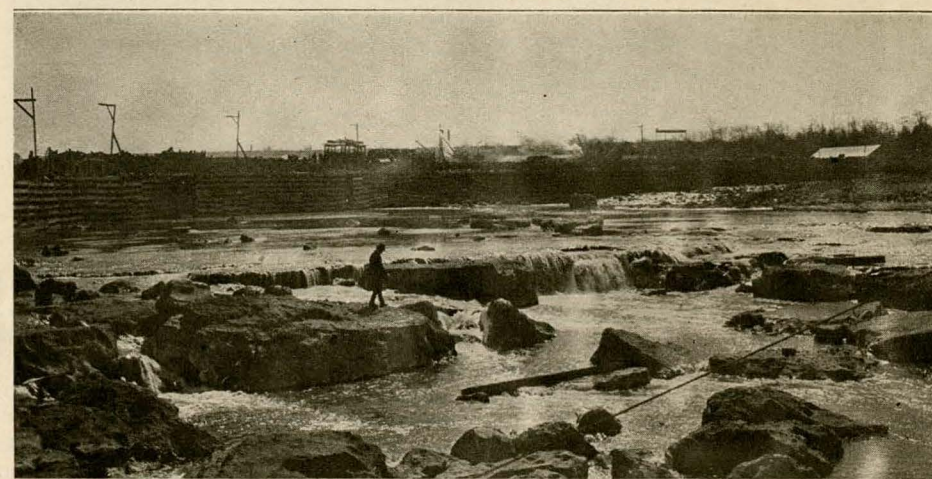
Horseshoe. If not entirely destroyed by a reduction of several feet in the level of the upper river, the American Falls will be reduced to a pitiful dribble for the reason just stated, and also because the channel to these falls, while only 340 feet wide at a point a little below the head of Goat Island, spreads out to a width of 1,060 feet at the edge of the cataract. This means that an average depth of six feet across this channel at its narrowest point will give only an average depth of two feet of water on the crest of the American Falls, the velocity being the same in both places. On the crest of the Horseshoe Falls, the length of contour is 3,010 feet; while the width of the Canadian channel on a line with the head of Goat Island is some 3,700 feet, so that the average depth of water increases as it nears the cataract.

American and Canadian Falls Compared

With normal water level in Lake Erie, the height of the American Falls is 165 feet, while that of the Horseshoe Falls is 158 feet, at the water line. No doubt the water level in the Gorge is somewhat lower at the foot of the former of these two falls; but if this difference is taken as one foot, which is probably more than the actual amount, the crest of the American is still six feet higher than that of the Horseshoe Falls. While the sheet of water flowing over the American cataract is no more than three or four feet in thickness at its deepest points, the depth of water near the center of the Horseshoe Falls is known to be at least sixteen feet, because a vessel of that draught went over them some years ago. During the construction of the intake works of one of the great power plants in Queen Victoria Park, depths of water between 19 and 26 feet were found at points some 2,000 feet above the Horseshoe Falls and about 500 feet from the original shore line. This makes it probable that there is a depth of more than 16 feet along a part of the crest of these falls. Even with a depth of 16 feet at the Horseshoe, and as much as four feet of water at the American Falls, the shelf of limestone over which the latter flow must be some 18 feet higher than the corresponding shelf between Goat Island

and the Canadian bank. The lower elevation of the Canadian channel continues up stream, past the head of Goat Island and the first line of breakers, to the smooth water above the rapids, where the normal river level between the New York and Canadian banks is about 557 feet above tidewater. A little above the first row of breakers, on a line crossing the river near the head of Goat Island, and some 500 to 600 feet from the Canadian bank, the limestone bed of the stream is 13 to 16 feet beneath the surface elevation of 557 feet just named. On this same line the depth of water just above the entrance to the American

the head of Goat Island; and the other part should extend from the point just named, down through the narrow neck that forms the upper end of the passage between Goat Island and the New York bank. These two parts of the deepened channel would meet at an angle of perhaps 30 degrees. Such an artificial channel 100 to 200 feet in width and of suitable depth would carry an ample supply of water for the American cataract as long as there was any considerable amount going over the Horseshoe Falls, even though the level of the upper Niagara river were so reduced that the natural channel between Goat Island and the



BED OF RIVER ABOVE HORSESHOE FALLS.
Laid bare through construction of a cofferdam.

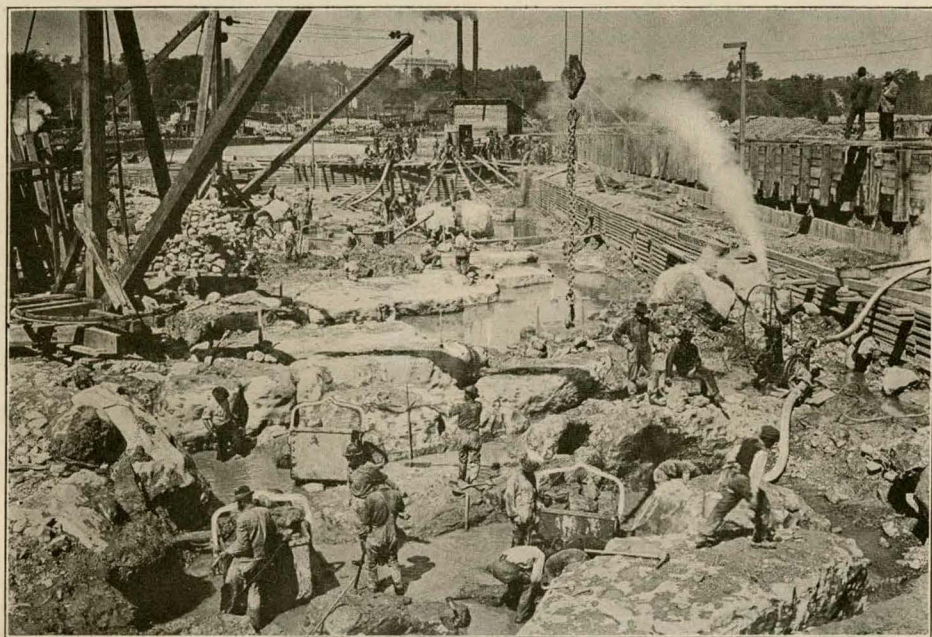
channel is probably not more than five to six feet. From the surface elevation of about 557 feet, the river falls some 56 feet in the rapids above the Horseshoe, and about 50 feet in those leading to the American Falls. Much the greater part of this descent between Goat Island and the New York bank, occurs along the thousand feet of channel above Bath Island; and this fact makes comparatively simple the problem of excavation to ensure an ample volume of water at the cataract below.

Proposed Line of New Channel

One part of the deepened channel should run diagonally out into the river toward the international boundary line, from a point several hundred feet above

New York bank would be laid bare above Bath Island.

It is worth noting, not only that no excavation would be necessary below Bath Island, but also that the greater elevation by probably as much as 18 feet of the rocky shelf of the American above that of the Horseshoe Falls would not prevent the delivery of an ample volume of water over the former. The reason for this is that the division of water for the two cataracts must take place above the head of Goat Island, where the surface elevation of the river is some fifty feet higher than the crests of the falls and after this division has been made, the relative elevations at the two falls cannot affect the results. The flow of water to the American Falls is now



EXCAVATING CANADIAN CHANNEL TO MAKE FOREBAY FOR ELECTRIC PLANT.

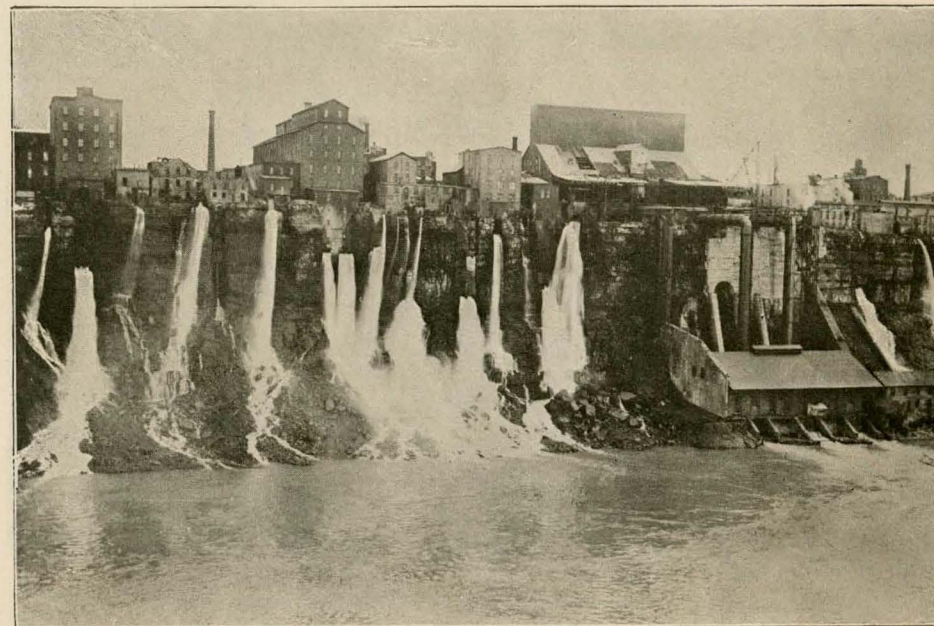
throttled by the high ledge of rock in the river-bed just above the head of Goat Island and in the upper part of the channel between that island and the New York bank. By the proposed artificial channel, this barrier of rock will be pierced, and the greatest menace to the preservation of the American Falls removed. With the upper river at its present height, the proposed artificial channel, after its completion, would be entirely covered with water; but when the upper river had been lowered several feet, so as to lay bare the natural channel between the head of Goat Island and the New York bank, the artificial channel near the center of the natural one would appear as a wide and deep canal running full of water for the supply of the falls below. A little above Bath Island this canal would end, and its water would spread out for its plunge over the crest of the American Falls.

If it were desired to maintain the present appearance of the American channel above Bath Island, the deep canal-like cut from a point in the river-bed near the international boundary line might terminate just above Goat Island; and then the natural channel might be deep-

ened the necessary number of feet over the entire width of its upper part. From an æsthetic point of view, this is no doubt the better plan.

There can hardly be a question that the excavation here proposed would be entirely effective to preserve the American Falls, for whatever water rights may have been or may in future be granted along the Niagara river by New York and Ontario, it is not to be expected that capital would be invested in new power plants about the Falls to an extent that would drain most of the water out of the Canadian channel, as this would destroy the value of the three great plants in Queen Victoria Park. As long as there is a goodly flow of water down the Canadian channel, the proposed excavation on the New York side will ensure the preservation of the American Falls.

It may be objected that the excavation of the upper channel to the American Falls will cost, perhaps, a million or two of dollars; but this is a small price to pay for the privilege of developing a million or more of horse-power, and at the same time preserving these Falls in their original condition. In fact, for the grant of a single location and water

A HINT OF HOW THE FUTURE NIAGARA MAY LOOK.
Power houses, mills, and factories now standing along the lower river front.

right on the upper shore of Prospect Park, the State of New York could no doubt obtain an annual rental that would pay the entire interest on the investment necessary to make the proposed excavation.

Dry Niagara

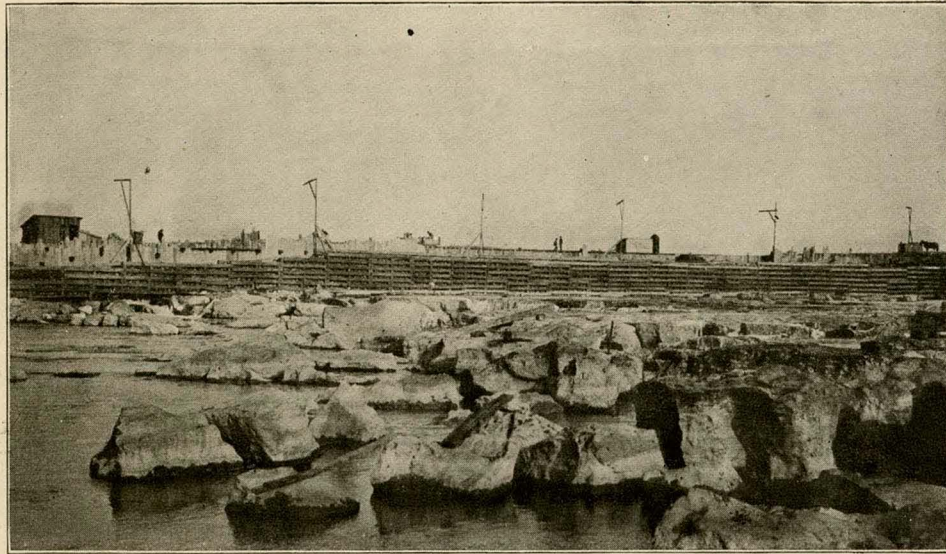
That destruction of the American Falls is certain to follow a reduction of a few feet in the level of the upper Niagara river, in the present condition of the channel, has been proved by the actual happening of the event. In the winter of 1903-04, an ice-jam in Niagara river so reduced its level that the flow stopped over the American Falls, save as to a small stream between Prospect Point and the first projection along the crest. On February 14, 1896, the river was so low that no water passed over the crest of the American Falls between Goat Island and Luna Island, and the Cave of the Winds was laid bare. In November of the same year, the limestone bed of the river over a wide stretch above the Three Sisters Islands and adjoining the head of Goat Island, was exposed to view by the recession of the waters into the Canadian channel. Because of an ice-

gorge at the foot of Lake Erie, in 1848, the American Falls came temporarily to an end.

It is time for instant action. Shall we wait until the sublimest spectacle in the United States is destroyed?

The Burton Resolution

In this connection, important legislative action has been inaugurated in Congress by the passage through the House of Representatives of a joint resolution looking to the preservation of Niagara Falls, introduced by Representative Theodore E. Burton, of Cleveland, Ohio, chairman of the House Committee on Rivers and Harbors, and now (Feb. 15) pending in the Senate. It will be remembered that by Act of Congress of June 13, 1902, an International Commission was created to arrange with the Dominion of Canada the method of controlling the boundary waters connected with the Great Lakes. The Commission includes three American members (two engineers and one lawyer), and three members appointed by Canada. The Commissioners have been considering the problems submitted to them for nearly a year, including especially the diversion



BED OF RAPIDS IN CANADIAN CHANNEL UNCOVERED BY COFFERDAM.
Water here was about twenty feet deep.

of the water for power plants, the exact boundary line between the United States and Canada, and the use of the navigable channels which pass from one side to the other of the boundary line. They have already considered the diversion of the water for power plants in Niagara river at the Falls. While their immediate jurisdiction has to do with questions of hydraulics alone, they have also had under consideration the danger of destroying the artistic beauty of the cataract, and it is believed they are all ready to recommend such measures as will put a stop to further desecration.

Mr. Burton's resolution calls upon the American members to make a report at an early day, of the best method to be

employed to save the Falls from further depletion. It also directs them to use all possible efforts with the Canadian members to preserve them. Of course the Congress of the United States can direct only the three members from the United States; but it is thought that the Canadian members are equally favorable to any measures required for the accomplishment of the desired end. Eminent lawyers have expressed the opinion that the best method to preserve Niagara Falls from further injury is by international treaty between Great Britain (representing Canada) and the United States; and it is thought that this resolution will be an entering wedge to secure such a treaty or agreement.



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